

Measurements of Infrared Radiative Properties of Crystal Materials at High Temperatures

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The radiative properties of semi-transparent crystal materials are important physical parameters in applications. Zinc sulfide crystal material, which has the advantages of high mechanical strength, high hardness, erosion resistant, and excellent optical transmission from the visible to infrared wavelengths, is the investigated semi-transparent material in this paper. A measurement method was established to determine the optical constants of high-temperature semi-transparent materials in the infrared spectra based on the measurements of apparent spectral radiative properties at different angles and background source conditions. Based on the analysis of radiative transfer, the inverse accuracy for the optical constants using the Levenberg-Marquardt algorithm was numerically verified to give the optimized measurement conditions of apparent radiative properties. The experimental apparatus measuring the apparent radiative properties of semi-transparent materials was established using a FTIR spectrometer, a heating cavity and a standard high-temperature source. High-temperature experiments with ZnS sample were used to experimentally verify the method. The inverse solution results agree well with reported data in the literature. This research works provides a reference for measurements of high-temperature radiation properties of semi-transparent materials in multi-layer structure.